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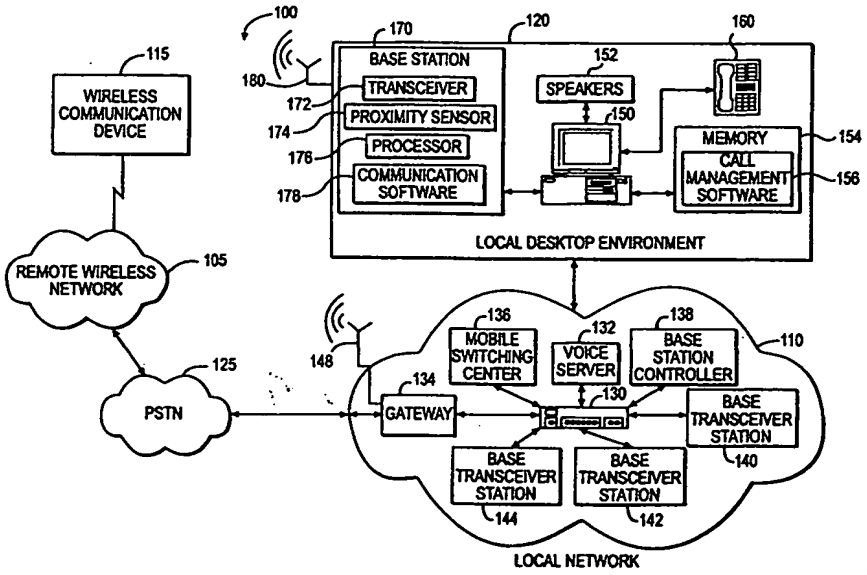

(57) Abstract

Systems and methods automatically hand–off calls and call information, without interruption, between a mobile communication device in a communication with a remote network and a reference point in communication with a local network. A proximity sensing device senses when a wireless communication device is within a predetermined range of the reference point and signals a switching center to initiate a call hand–off from the remote network to the local network. When the wireless communication device moves away from the reference point, the call is automatically transferred back to the remote network.

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SYSTEM AND METHOD FOR CONTROLLING, MAINTAINING AND SHARING CALLS AND CALL DATA BETWEEN NETWORKS

Background of the Invention

The present invention relates generally to communication systems, and more particularly to a system and method for automatically handing-off calls and call information in a seamless manner between a mobile communication device in communication with a remote network and a reference unit in communication with a local computer voice/data network.

Originally, public branch exchanges (PBXs) were created to handle problems associated with integrating and managing connections between two networks: the internal enterprise network and the external public switched telephone network (PSTN). Two primary functions of the PBX are consolidation and reuse. That is, instead of providing a PSTN line for everyone, the PBX creates a pool of lines for an internal group. Over the years, the PBX has provided users and network managers with solutions such as Direct Inward Dialing (DID), which uses a single number for both internal and external networks.

With the advent of wireless communication networks, a new level of problems has arisen stemming from the lack of interoperability between the traditional landline network and the modern wireless network. Attempts to integrate multiple landline networks (*e.g.*, enterprise, PSTN, Data/Internet Protocol(IP)) with multiple wireless networks (*e.g.*, in-building, Personal Communication System (PCS), and Advanced Mobile Phone System (AMPS)) often exacerbate these problems.

The problems associated with integrating multiple networks include behavioral problems and technical problems. The value of solving the behavioral problems accrues to the end-user of the networks (*e.g.*, the person with a mobile telephone on their belt, a proprietary digital telephone on their desk, and an IP or computer telephony integration (CTI) solution in their computer). The value of solving the technical problems accrues to the carrier or information technology (IT) group within an enterprise.

One behavioral problem involves the need to learn different telephone usage for each network. Users typically have a different telephone device or interface for each network, and thus must learn how to use each device or interface and remember the differences. In addition, users must change devices or interfaces when changing networks which often requires behavior that is not natural. For example, users must currently physically dock their wireless products to communicate with computers or other networks. In addition, each device or network has particular strengths and weaknesses, causing the user to choose and switch between them for each call. Providing a seamless communication link between two of the most popular and fast-growing networks--mobile telephone and the computer voice/data network--offers many advantages.

Another behavioral problem users face is data sharing. Creating personal directories and remembering on which device calls arrived adds to the mental load on a user and reduces work productivity. Many wireless users prefer storing data on their mobile phones since they always carry them. This action, however, prevents the data from being immediately accessible through contact management software on their desktop computer or their desktop telephone. Although some users can share data between certain mobile communication devices (*e.g.*, hand-held computer with modem) and a desktop computer, this procedure is often inconvenient. Consequently, some users create directories and access information on up to five devices: their desktop telephone, mobile telephone, in-building wireless telephone, home telephone and computer. The emergence of the World Wide Web ("Web") and the Intranet in particular adds a new dimension to this problem since much of the data is no longer available via any route except the Web (*e.g.*, corporate phone and e-mail directories).

Technical problems encountered by users include limited interoperability between networks. As more people acquire some form of wireless telephone--either cellular, PCS, cordless, or in-building wireless--companies will need to integrate these networks to provide, for example, in-building wireless solutions which also access the full cellular network when the user is away from the office. To meet this need, data and voice networks are moving towards integration via IP and asynchronous transfer mode (ATM) technology. While the long term solution may be a completely wireless

system, this will not likely occur in the near future, so alternatives will be needed to bridge existing networks together. This creates the problem of managing multiple solutions for each network. For an enterprise, the problem is expense and complexity (*i.e.*, providing multiple physical and network solutions for each user).

Yet another technical problem for an enterprise is available bandwidth for wireless products. Theoretically, wireless users should use a wired telephone or IP computer voice solution, when they are available. However, field trials and other studies indicate that wireless users still prefer their wireless telephone in those situations. Many in-building wireless users start calls at their desks and then move away during the call, which increases traffic on the wireless network. Although these users could manually hand-off the call, doing so interrupts the conversation.

Currently, access to wireless devices is broadly limited by network administrators. To conserve the limited bandwidth of in-building wireless networks and airtime expenses for cellular, telecom managers restrict the number of mobile telephones issued to employees. At the same time, however, they acknowledge that an increasing number of users realize the value of wireless telephones and feel their productivity would be increased by having one. Nonetheless, telecom managers attempt to reduce wireless traffic and expenses by requesting that users follow certain rules about using the in-building network. The same applies to sending voice over IP, which can reduce toll expenses. Currently, however, there is no incentive for users to follow those rules and they typically take the easiest approach, which often means using their wireless telephone.

These problems will certainly escalate with the increase of wireless telephones in the business environment. Many users will continue to use a single communication device (*e.g.*, mobile telephone). For example, in-building wireless users will avoid switching between devices by using their mobile sets (and thus valuable bandwidth) for all calls, even while at their desk.

It would be desirable to have seamless communication between a wireless communication device (*e.g.*, mobile telephone) and a computer data/voice network so that an existing call on the wireless communication device can be automatically handed off to the computer data/voice network without interruption.

Summary of the Invention

Systems and methods consistent with the present invention automatically hand-off calls and call information in a seamless manner between a wireless communication device in communication with a remote network and a reference unit in communication with a local computer data/voice network.

Specifically, a system for automatically transferring a call between a first and second network comprises a communication device in communication with the first network; a reference unit in communication with the second network; proximity sensing means for determining whether the communication device is within a predetermined range of the reference unit; and call transfer means, coupled to the proximity sensing means, for transferring a call on the communication device from the first network to the second network, without interrupting the call, if the communication device is within a predetermined range of the reference unit.

A method for automatically transferring a call between a remote network and a local network, comprises detecting a wireless communication device operating on the remote network within a predetermined range of a reference point operating on the local network; and automatically transferring an existing call, without interruption, between the remote network and the local network if the wireless communication device is within the predetermined range of the reference point.

Both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

Brief Description of the Drawings

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate presently preferred embodiments of the invention and, together with the preceding general description and the following detailed description, explain the principles of the invention.

In the drawings:

Fig. 1 is a diagram of a call hand-off system consistent with the present invention;

Fig. 2 is a flowchart of a method, consistent with the present invention, for automatically handing-off a call between a plurality of networks;

Fig. 3a is an illustration of the hand-off of an existing call to a local network, consistent with the present invention, as a wireless communication device user enters a building;

Fig. 3b is an illustration of the hand-off of an existing call to a local desktop environment, consistent with the present invention, as a wireless communication device user enters an office; and

Fig. 4 is a flowchart of a method, consistent with the present invention, for handing-off a call between a local network and a remote network.

Detailed Description of the Invention

Reference will now be made in detail to the construction and operation of preferred embodiments consistent with the present invention illustrated in the accompanying drawings. In those drawings, like elements and operations are designated with the same reference numbers.

Methods and apparatus consistent with the present invention automatically hand-off calls and call information in a seamless manner between a wireless communication device in communication with a remote network and a reference unit in communication with a local computer data/voice network. For example, such methods and apparatus allow a user of a wireless communication device (*e.g.*, mobile phone or portable computer) to enter or leave his or her office during a conversation without any interruption in service. This is accomplished by seamlessly integrating in-building computer data/voice networks with remote wireless networks such that an existing call on a mobile telephone can be automatically handed-off to a wired desktop device. In addition, call information (*e.g.*, telephone directories and call histories) and other data can also be automatically handed-off from the wireless communication device to a wired desktop device. Moreover, in some implementations, a user can view the handed-off information through an IP interface on a computer screen at their desktop.

Fig. 1 illustrates a call hand-off system 100 consistent with the present invention. Call hand-off system 100 includes a remote wireless network 105 and a local network 110 that communicate via PSTN 125. Remote wireless network 105

can be any wireless wide area network that supports voice and data transmission via a wireless communication device 115. For example, remote wireless network 105 can be an AMPS network that supports analog wireless communications or a PCS network that supports digital wireless communications. In either instance, remote wireless network 105 can transmit voice and data signals to wireless communication device 115 to establish a call or transfer information. Thus, remote wireless network 105 can provide wireless communication services for virtually any type of device configured to support voice and/or data.

Wireless communication device 115 can be any type of device configured to communicate voice and data signals to and from remote wireless network 105. Thus, a wireless communication device can be a mobile telephone or a computer equipped with communication capabilities (*i.e.*, Palm Pilot™ or Newton™). In addition, wireless communication device 115 can be a pager or other form of wireless device that supports either analog or digital transmission. Each wireless communication device 115 configured to operate with remote wireless network 105 includes an identification code that is used to identify the device within the network. For example, when a landline telephone user dials the telephone number (or IP address) of wireless communication device 115, the call is routed to remote network 105, which then hand-offs the call to wireless communication device 115 using its identification code.

Local network 110 is a computer voice and/or data network configured to operate in a limited area, such as a building or areas surrounding a building. Local network 110 preferably includes wireless and wireline communication systems that support voice and IP protocol to provide building residents with a plurality of communication options. For example, local network 110 may include an in-building wireless system (*e.g.*, Nortel's Companion Microcellular™ system) that allows users to make internal and external calls using a wireless communication device. These wireless communication devices, however, can only be operated within a predetermined local network 110 service area. Embodiments consistent with the present invention allow users to operate their wireless communication device beyond local network 110 by handing-off the call to remote wireless network 105. To facilitate this feature, local network 110 includes a hub 130, a voice server 132, a

gateway 134, a mobile switching center 136, a base station controller 138, a plurality of base transceiver stations 140, 142 and 144, and network switching software 146. One skilled in the art will appreciate that the configuration of local network 110 may be modified to meet the needs of a specific building or campus environment.

Hub 130 is a common connection point for components of local network 110 and includes multiple ports for routing voice and data signals. Thus, voice and data signals transferred between components of local network 110 are routed through hub 130. Hub 130 also receives voice and data signals from sources external to local network 110. For example, if a user were to make an external telephone call from a building serviced by local network 110, a voice signal would be routed from the telephone to hub 130. At that point, the voice signal would be routed within local network 110 and ultimately to a destination terminal via PSTN 125.

Voice server 132 is a voice mail system for local network 110. For example, if an external telephone call is received at local network 110, and an attempt to route the telephone call to local desktop environment 120 is unsuccessful, the caller can leave a voice mail message on voice server 132 for the intended party. Subsequently, the intended party can access its mailbox on voice server 132 to retrieve the saved message. Local network 110 users can also record a greeting for potential callers on voice server 132. One skilled in the art will appreciate that other voice mail features can be implemented by voice server 132 consistent with the embodiments of the present invention.

Gateway 134 serves as a communication link between local network 110 and external networks such as PSTN 125 or the Internet. When a user of local network 110 makes a telephone call, voice signals are sent through local network 110 and routed to PSTN 125 via gateway 134. Gateway 134 also receives voice and data signals from PSTN 125 and transfers these signals to hub 130 for routing. In addition, gateway 134 may be configured to communicate directly with an external wireless network via antenna 148.

Mobile switching center 136 includes hardware and software components for handing-off a call and call information between local network 110 and other networks, such as remote network 105. The hardware components of mobile switching center

136 include one or more switching devices to handle several call hand-offs simultaneously. The software components of mobile switching center 136 include network switching software. Network switching software is executable code that performs the necessary steps to provide seamless call hand-offs between multiple networks. The method of handing-off an existing call and call information between networks is provided in greater detail below with reference to Figure 4.

Base station controller 138 is configured to control base stations located within the local environment through a wireless or wireline communication link. A base station is a communication device that facilitates seamless hand-offs of in-building wireless calls. That is, if a building is equipped with a local wireless communication network, base stations are strategically placed therein to allow employees to "roam" within the building while on an existing call without interruption. Base station controller 138 continuously monitors each base station and can be configured to operate in different modes (*e.g.*, a day mode for higher traffic volume and a night mode for lower traffic volume). In addition, base station controller 138 can monitor each base station from within the local environment or from a remote location.

Several base transceiver stations 140, 142, and 144 are controlled by base station controller 138 to support an in-building wireless network. Each base station transceiver can support multiple base stations located throughout a facility. Base station controller 138 communicates with each of these base stations through base transceiver stations 140, 142, and 144 and antenna 148. One skilled in the art will appreciate that base transceiver stations may be added to or removed from local network 110, as necessary.

Local network 110 may be configured to support PCS, AMPS, code-division multiple access (CDMA); time-division multiple access (TDMA), the global system for mobile communications (GSM), and other communication technologies. For example, with GSM, components within local network 110 can emulate GSM base stations, base station controllers, and mobile switching centers. Thus, users of current GSM telephones can take advantage of embodiments consistent with the present invention without any changes to their handset.

Connected to local network 110 are a plurality of end terminals located throughout the facility. These end terminals include telephones, fax machines, computers, video conferencing systems and other communication devices. Preferably, one or more of these end terminals are located in a local desktop environment 120 provided in each office or workstation cubicle of the facility. Thus, when a telephone call or a data transmission is received at the facility, local network 110 routes the call or transmission to appropriate end terminals within local desktop environment 120. Since local network 110 is a computer voice/data network, the call or data transmission may be routed over a wireless or wireline communication channel to more than one end terminal (*e.g.*, a speakerphone and a computer for a video conference) in local desktop environment 120. As illustrated in Fig. 1, local desktop environment 120 includes a computer 150, speakers 152, memory 154, a telephone 160, and a base station 170. One skilled in the art will appreciate that additional components may be added to local desktop environment 120, such as a fax machine or other peripheral device.

Computer 150 is preferably a desktop computer that includes a processor, a disk drive, input/output devices (*e.g.*, a display, a keyboard, microphone, and a mouse), and a communication port for receiving and sending voice and data signals over local network 110. Computer 150 is configured to support IP and CTI technology and thus, can receive calls via the Internet or an intranet. Local desktop environment 120 also includes loudspeakers 152 which communicate with computer 150 to output audio signals. For at least one embodiment consistent with the present invention, speakers 152 output audio signals from a telephone call handed-off to computer 150 from wireless communication device 115. Speakers 152 may also be used for multimedia applications.

Memory 154 is random access memory (RAM) that stores data and software for computer 150. In particular, memory 154 includes call management software 156 which is supported by the operating system of computer 150 and generates a graphical user interface on a display to output call information and other data. The output of call information may include call time, call history, information about calling party (*e.g.*, typically provided by contact management software), remote wireless network

information, and any other data call management software 156 is configured to display. In addition, call management software 156 may be used to display information regarding the transfer of data from wireless communication device 115 and computer 150 (*e.g.*, calling directories, e-mail, voicemail, and other information). Alternatively, call management software 156 can be downloaded from an Internet server as necessary to output call information and other data.

Telephone 160 is preferably a digital telephone that includes a wide range of features. For example, telephone 160 may include speakerphone functionality, as well as customized calling functions, such as call forwarding, call transferring, call conferencing, and call waiting. These functions would be programmed into telephone 160 and supported by local network 110. Telephone 160 may be connected to local network 110 directly or through computer 150. Using embodiments consistent with the present invention, an existing wireless call may be automatically handed-off to telephone 160 without interruption when the wireless communication device is within a predetermined distance of local desktop environment 120.

Base station 170 supports an in-building wireless communication system and the hand-off of external calls thereto. Although base station 170 is shown as a stand alone unit in Fig. 1, one or more of its components may be integrated into the architecture of computer 150. Base station 170 may be configured to perform a variety of functions including proximity sensing and call routing. For example, base station 160 may be configured to sense whether a wireless communication device with an existing call is within a predetermined distance of local desktop environment 120. If this is determined, base station 170 can signal mobile switching center 136 to have the call handed-off to local desktop environment 120. To facilitate this operation, base station 170 includes a transceiver 172, a proximity sensor 174, a processor 176, and communication software 178.

Transceiver 172 sends voice and data signals to and receives voice and data signals from an external source, such as wireless communication device 115 and one of base transceiver stations 140, 142, and 144. These signals are communicated via antenna 180, and in certain circumstances, via a wireline connection through computer 150.

Proximity sensor 174 sends out pulse signals through transceiver 172 to sense whether a user of wireless communication device 115, on an existing call, has entered their office. Wireless communication device 115 includes an identification code (used to identify itself to remote wireless network 105) that is detected by proximity sensor 174 when in range. This detection can be accomplished by generating low power radio signals, using an infrared beam, or implementing other short-range communication technology that creates a signal which extends a predetermined distance away from local desktop environment 120. This distance can be programmed by a network operator, for example, to extend between one meter and ten meters, depending on the size of the office. By programming each proximity sensor in this manner, a network operator can reduce the possibility of interference with other proximity sensors in a facility.

Processor 176 controls base station 170 and processes information sent to and received from an external source, such as wireless communication device 115 or one of the base transceiver stations. For example, once proximity sensor 174 detects wireless communication device 115, processor 176 processes and routes the identification code information to mobile switching center 136 to initiate call hand-off. Processor 176 implements communication software 178 to identify the type of wireless communication device and its associated remote wireless network. Mobile switching center 136 uses this information to contact the appropriate remote wireless network service to initiate call and call information hand-off.

Fig. 2 is a flowchart of a method for automatically handing-off a call between a plurality of networks consistent with the present invention. One skilled in the art should recognize that a call, as described herein, includes the hand-off of voice and/or data signals between two or more network terminals. This method begins with detecting a wireless communication device within a predetermined distance from a reference point (step 200). The reference point can be any one of a plurality of devices depending on the configuration of local network 110. For example, local desktop environment 120 can serve as a reference point when a wireless communication device user enters their office while on an existing call. In this instance, local desktop environment 120 identifies the wireless communication device as the user approaches.

Subsequently, the call is automatically handed-off to computer 150 (or another local desktop environment component) while the wireless communication device is within the predetermined range of base station 170 (step 220).

Figs. 3a and 3b illustrate two call hand-off system configurations for implementing embodiments consistent with the present invention. The details of the call hand-off are explained below in connection with Fig. 4. Fig. 3a illustrates what happens in handing-off an existing call to local network 110 as a user with a wireless communication device enters a building. Fig. 3b illustrates what happens in handing-off an existing call to local desktop environment 120 as a user of a wireless communication device enters an office. One skilled in the art will appreciate that additional configurations may be used to seamlessly hand-off an existing call between a plurality of networks consistent with the present invention.

In Fig. 3a, a user with a wireless communication device 115 enters a building 300, having local network 110, while on an existing call. The existing call is serviced by remote wireless network 105 while the user is outside of building 300. Upon entering the building, local network 110, serving as a reference point, detects wireless communication device 115 via antenna 148 using one or more proximity sensors located, for example, at the entrances of building 300. Local network 110 captures the identification code of wireless communication device 115 and uses this information to hand-off the call from remote wireless network 105 to an in-building wireless system supported by local network 110. Once the existing call is handed-off to local network 110, it can then be routed to any local desktop environment within building 300. The number of wireless communication channels available to local network 110 may vary based on the available bandwidth of the system. However, as users leave building 300, the calls are transferred back to remote wireless network 105 and additional wireless communication channels become available for other users.

Fig. 3b illustrates a user entering an office 320 with local desktop environment 120. In this embodiment, the user of wireless communication device 115 remains connected with remote wireless network 105 until reaching his or her office in building 300. Upon reaching the radio range, the wireless communication device is detected and identified by base station 170 via antenna 180. At this point, the display screen of

computer 150 becomes active and shows the status of the automatic call hand-off between remote wireless network 105 and local network 110. Once the call is handed-off to local desktop environment 120, the user can listen to the existing call while viewing call-related information through the call management software 156 interface on computer 150 described in further detail below. Local desktop environment 120 automatically hands-off the call back to remote wireless network 105 and wireless communication device 115 without any interruption in service when the user leaves office 320 (*i.e.*, moves out of radio range).

Fig. 4 is a flowchart of a method for switching a call between a plurality of networks consistent with the present invention. The method of Fig. 4 begins with the step of detecting a wireless communication device within a predetermined range of a reference unit (step 400). As stated above, this detection may occur when a wireless communication device user enters their building or office while engaged in an existing call. Thus, the reference unit may be local network 110 or local desktop environment 120 depending on the building network configuration.

The next step is identifying the wireless communication device and its supporting network (step 420). This step involves reading the identification code of the wireless communication device. Based on the identification code, local network 110 (or local desktop environment 120) can identify the remote wireless network supporting wireless communication device 115, that is, whether the remote wireless network is a PCS network, AMPS network, or other wireless network. Upon making this determination, local network 110 sends a request to remote wireless network 105 to hand-off the call to that network (step 440). The request includes the identification code of wireless communication device 115 and telephone number or IP address of local network 110.

Remote wireless network 105 receives the request from local network 110 and hands-off the call (step 460). To ensure the call is not interrupted, the hand-off is instantaneous, by routing the call immediately through PSTN 125 to local network 110. Since local network 110 is a computer data/voice network, it can receive calls and data transmission using IP protocol. In this instance, the call or data files can be

handed-off to local network 110 via the Internet and ultimately routed to local desktop environment 120.

After a call is routed to local desktop environment 120, the user can view call information through the call management software 156 interface and listen to an audio portion of the call through speakers 152 or through a wireless communication device. The user can also pre-configure the audio and visual functions of local desktop environment 120 or set these functions during the call. One advantage of this configuration is hands-free operation. That is, the user can configure local desktop environment 120 in a manner that doesn't require holding the communication device or other equipment.

Once a call is complete, the user can hang-up on wireless communication device 115 or through the call management software 156 interface. If the user initiates a call on computer 150 and has to leave the office during the call, local network 110 can hand-off the call back to remote wireless network 105 and wireless communication device 115 by modifying the steps illustrated in Fig. 4. As the user leaves the office (or building), proximity sensor 174 detects wireless communication device 115 moving away from local desktop environment 120, and local network 110 communicates with remote wireless network 105 to hand-off the call. A signal (*e.g.*, a beeping tone) can be sent to wireless communication device 115 by remote network 105 to alert the user of the call hand-off. The call is then automatically switched to remote wireless network 105 and wireless communication device 115 before the user leaves the radio range of base station controller 170. This feature allows the user to move in and out of their office (or building) while on an existing call without any interruption in service.

Embodiments consistent with the present invention provide increased mobility and versatility over conventional communication systems. A user can simply walk in and out of their office or building while on a call without interruption in service. The transparent and automatic hand-off of the call between networks provides this convenient functionality. In addition, embodiments consistent with the present invention allow a user transfer data between networks to consolidate communication information, such a calling directories and e-mail. This feature creates multiple user control points for accessing data existing on different networks.

While only some embodiments consistent with the present invention have been described, those skilled in the art will understand that various changes and modifications may be made to these embodiments, and equivalents may be substituted for elements in these embodiments, without departing from the true scope of the invention.

In addition, many modifications may be made to adapt a particular element, technique or implementation to the teachings of the present invention without departing from the central scope of the invention. Therefore, this invention should not be limited to the particular embodiments and methods disclosed herein, but should include all embodiments falling within the scope of the appended claims.

What is Claimed is:

1. A system for automatically transferring a call between a first and second network, comprising:

a communication device in communication with the first network;

a reference unit in communication with the second network;

proximity sensing means for determining whether the communication device is within a predetermined range of the reference unit; and

call transfer means, coupled to the proximity sensing means, for transferring a call on the communication device from the first network to the second network, without interrupting the call, if the communication device is within a predetermined range of the reference unit.

2. The system of claim 1 wherein the reference unit includes a display; and

a call management interface for generating information about the call on the display.

3. The system of claim 1 wherein the reference unit includes a communication device.

4. The system of claim 1 wherein the reference unit includes a computer.

5. The system of claim 1 wherein the reference unit includes speakers for outputting audio signals associated with the call.

6. The system of claim 1 wherein the first network includes a wide area network.

7. The system of claim 1 wherein the second network includes a local area network.

8. The system of claim 1 wherein the first network includes a wireless communication network.

9. The system of claim 1 wherein the second network includes a computer voice/data network.

10. The system of claim 1 wherein the communication device includes a mobile telephone.

11. The system of claim 1 wherein the proximity sensing means includes a base station connected to the reference unit.

12. The system of claim 1 wherein the reference unit contains the proximity sensing means.

13. The system of claim 1 wherein the second network includes a base station controller.

14. The system of claim 1 wherein the call transfer means includes a mobile switching means for generating a call transfer request.

15. The system of claim 1 wherein the second network includes a gateway.

16. The system of claim 1 wherein the second network includes a base transceiver station.

17. A reference unit in communication with a local network, comprising:

means for detecting a wireless communication device in the process of connecting an existing call;

means for identifying the wireless communication device and a remote network used in connecting the existing call to the wireless communication device;

means for sending a request to the remote network to hand-off the existing call to the local network without interruption; and

means for receiving the existing call from the remote network.

18. The reference unit of claim 17 wherein the local network includes a computer voice/data network.

19. The reference unit of claim 17 wherein the second network includes a wireless network.

20. The reference unit of claim 17 wherein the wireless communication device includes a mobile telephone.

21. The reference unit of claim 17 wherein the detecting means includes means for detecting an identification code associated with the wireless communication device.

22. The reference unit of claim 17 further comprising speakers for outputting audio signals associated with the existing call.

23. The reference unit of claim 17 further comprising a computer.

24. A base unit connected to a local network and configured to communicate with a wireless communication device operating on a remote network, comprising;

proximity sensing means for detecting the presence of the wireless communication device within a predetermined physical range of the base unit; and

communication linking means for automatically linking an existing call on the wireless communication device to a reference unit connected to the local network.

25. The base unit of claim 24 wherein the reference unit includes a computer.

26. The base unit of claim 24 wherein the reference unit includes a stand-alone communication device.

27. The base unit of claim 24 wherein the remote network includes a wireless network.

28. The base unit of claim 24 wherein the local network includes a computer voice/data network.

29. A method for automatically transferring a call between a remote network and a local network, comprising:

detecting a wireless communication device operating on the remote network within a predetermined range of a reference point operating on the local network; and

automatically transferring an existing call, without interruption, between the remote network and the local network if the wireless communication device is within the predetermined range of the reference point.

30. The method of claim 29 wherein detecting includes generating radio waves to sense the wireless communication device.

31. The method of claim 29 wherein detecting includes generating an infrared beam to sense the wireless communication device.

32. The method of claim 29 wherein automatically transferring includes switching the existing call from the remote network to the local network in response to a request.

33. The method of claim 29 wherein automatically transferring includes switching the existing call from the remote network through a local mobile switching center.

34. The method of claim 29 wherein automatically transferring includes transferring data.

35. A method for transferring an existing call between a local network and a remote network, comprising:

detecting a wireless communication device in the process of connecting an existing call;

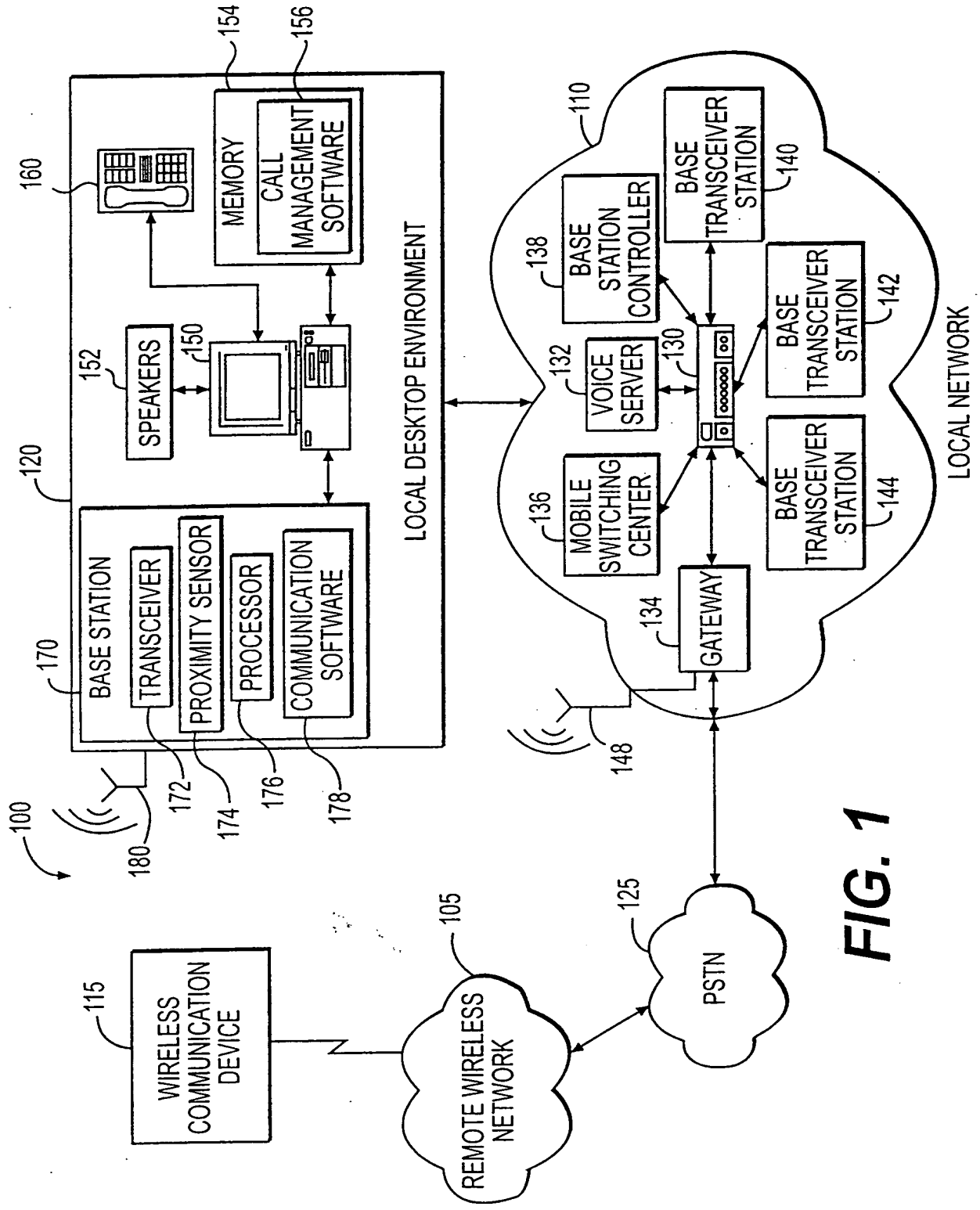
identifying the wireless communication device and the remote network connecting the existing call to the wireless communication device;

sending a request to the remote network to transfer the existing call to the local network without interruption; and

transferring the existing call from the remote network to the local network.

36. The method of claim 35 further comprising transferring the existing call from the wireless communication device to an end terminal connected to the local network.

37. The method of claim 35 further comprising transferring the existing call back to the remote network as the wireless communication device moves a predetermined distance away from the local network.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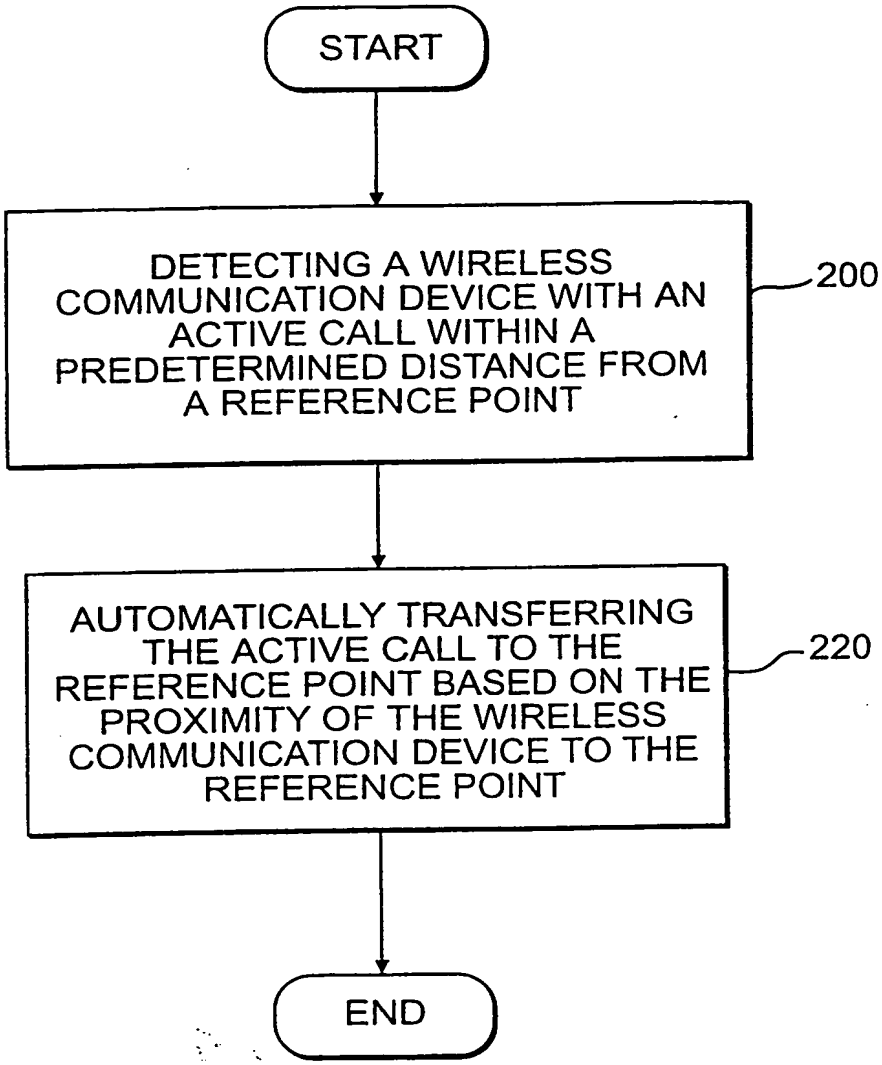
WIRELESS COMMUNICATION DEVICE
REMOTE WIRELESS NETWORK
PSTN
LOCAL NETWORK
LOCAL DESKTOP ENVIRONMENT
BASE STATION
TRANSCEIVER
PROXIMITY SENSOR
PROCESSOR
COMMUNICATION SOFTWARE
SPEAKERS
MEMORY
CALL MANAGEMENT SOFTWARE
GATEWAY
MOBILE SWITCHING CENTER
VOICE SERVER
BASE STATION CONTROLLER
BASE TRANSCEIVER STATION
BASE TRANSCEIVER STATION
BASE TRANSCEIVER STATION

FIG. 1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DETECTING A WIRELESS COMMUNICATION DEVICE WITH AN ACTIVE CALL WITHIN A PREDETERMINED DISTANCE FROM A REFERENCE POINT
200
AUTOMATICALLY TRANSFERRING THE ACTIVE CALL TO THE REFERENCE POINT BASED ON THE PROXIMITY OF THE WIRELESS COMMUNICATION DEVICE TO THE REFERENCE POINT
220
END

FIG. 2

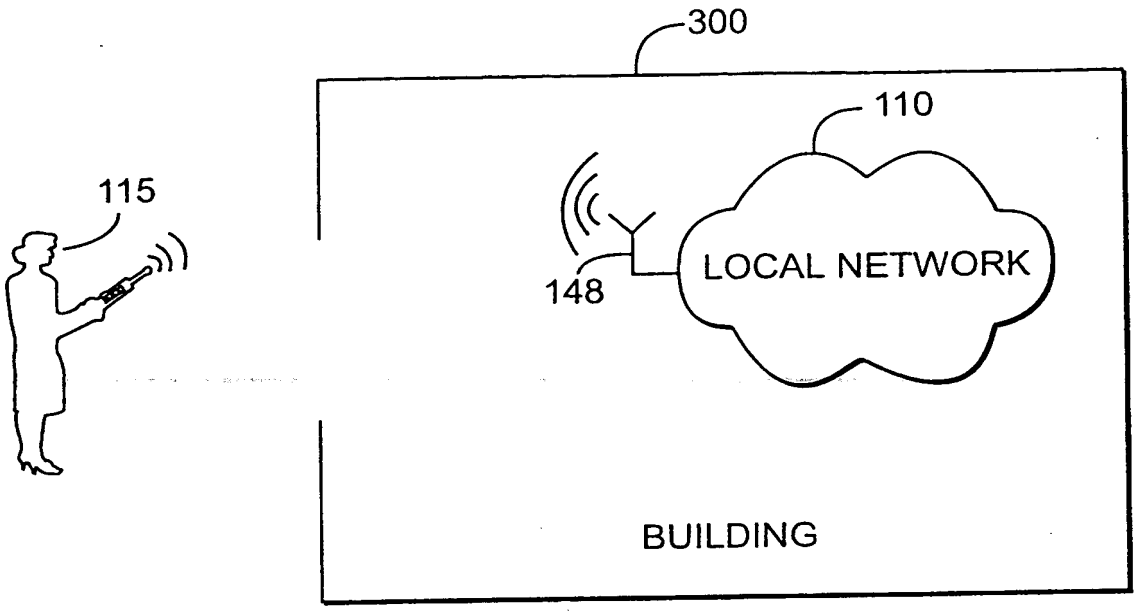

FIG. 3a

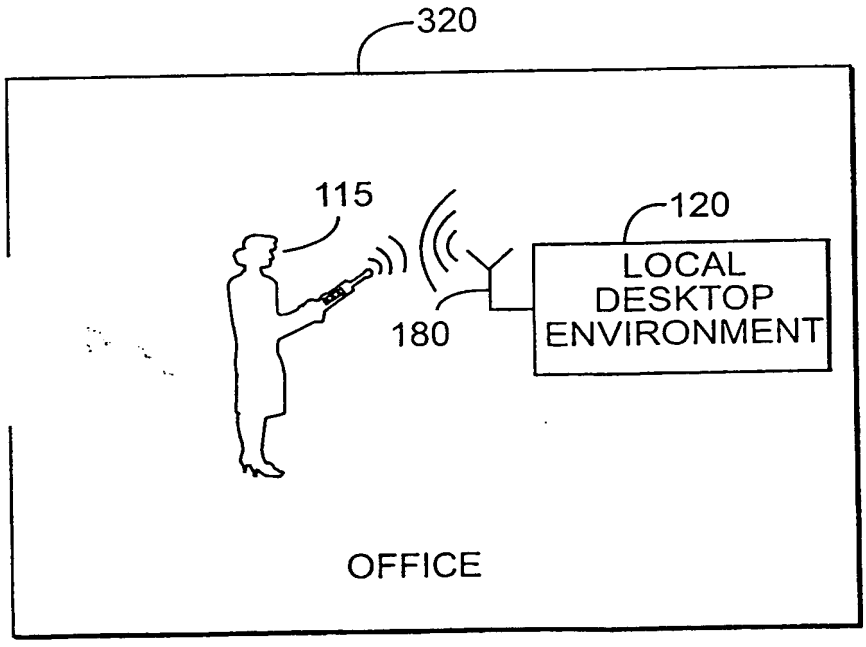

FIG. 3b

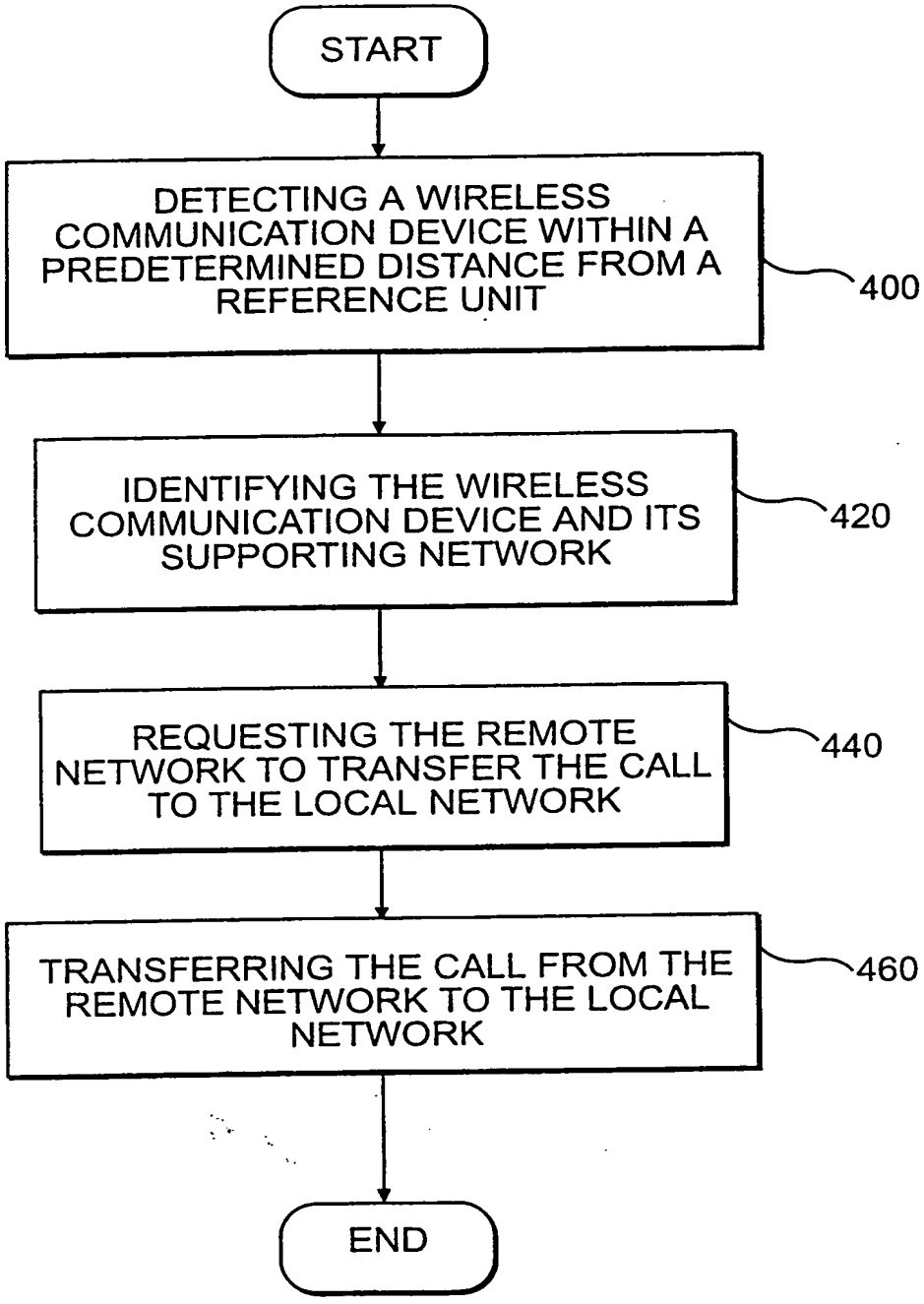
START
DETECTING A WIRELESS COMMUNICATION DEVICE WITHIN A PREDETERMINED DISTANCE FROM A REFERENCE UNIT
400
IDENTIFYING THE WIRELESS COMMUNICATION DEVICE AND ITS SUPPORTING NETWORK
420
REQUESTING THE REMOTE NETWORK TO TRANSFER THE CALL TO THE LOCAL NETWORK
440
TRANSFERRING THE CALL FROM THE REMOTE NETWORK TO THE LOCAL NETWORK
460
END

FIG. 4

INTERNATIONAL SEARCH REPORT

Inte .onal Application No
PCT/IB 99/01790

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/38 H04Q7/26 H04M3/54 H04M3/58

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 463 674 A (GILLIG STEVEN F ET AL) 31 October 1995 (1995-10-31) abstract; figures 1-4,7,8 column 1, line 45 -column 8, line 17	1-5,8, 10-17, 19,20, 22-27, 29,30, 32-37
Y		6,7,9, 18,28,31
Y	US 5 745 850 A (DAY JAMES FRANCIS ET AL) 28 April 1998 (1998-04-28) abstract; figure 1 column 6, line 56 -column 7, line 10	6,7,9, 18,28
Y	EP 0 806 878 A (ALSTHOM CGE ALCATEL) 12 November 1997 (1997-11-12) abstract	31

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 February 2000	09/02/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Willems, B

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INTERNATIONAL SEARCH REPORT

Inte[illegible]onal Application No
PCT/IB 99/01790

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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P,A	US 5 887 259 A (DION JOHN K ET AL) 23 March 1999 (1999-03-23) abstract	1-37

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Form PCT/ISA/210 (continuation of second sheet) (July 1992)

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Inter .onal Application No
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